Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 133)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -4x^5 + 5x^3 + 9x^2 + 7x + 2$$

$$q(x) = 6x^5 - x^4 + 9x^2 - 7x + 10$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-4)x^5 + (0)x^4 + (5)x^3 + (9)x^2 + (7)x^1 + (2)x^0 \\ q(x) &= (6)x^5 + (-1)x^4 + (0)x^3 + (9)x^2 + (-7)x^1 + (10)x^0 \\ p(x) - q(x) &= (-10)x^5 + (1)x^4 + (5)x^3 + (0)x^2 + (14)x^1 + (-8)x^0 \\ p(x) - q(x) &= -10x^5 + x^4 + 5x^3 + 14x - 8 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -7x^2 + 3x - 2$$

$$b(x) = 7x + 6$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-7x^2$	$3x$	-2
$7x$	$-49x^3$	$21x^2$	$-14x$
6	$-42x^2$	$18x$	-12

$$a(x) \cdot b(x) = -49x^3 + 21x^2 - 42x^2 - 14x + 18x - 12$$

Combine like terms.

$$a(x) \cdot b(x) = -49x^3 - 21x^2 + 4x - 12$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

Polynomial Operations SOLUTION (version 133)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 3x^3 - 25x^2 + 10x - 9 \\ g(x) &= x - 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x-8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 3 & -25 & 10 & -9 \\ 8 & & 24 & -8 & 16 \\ \hline & 3 & -1 & 2 & 7 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 3x^2 - x + 2 + \frac{7}{x-8}$$

In other words, $h(x) = 3x^2 - x + 2$ and the remainder is $R = 7$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 3x^3 - 25x^2 + 10x - 9$. Evaluate $f(8)$.

You could do this the hard way.

$$\begin{aligned} f(8) &= (3)\cdot(8)^3 + (-25)\cdot(8)^2 + (10)\cdot(8) + (-9) \\ &= (3)\cdot(512) + (-25)\cdot(64) + (10)\cdot(8) + (-9) \\ &= (1536) + (-1600) + (80) + (-9) \\ &= 7 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(8)$ equals the remainder when $f(x)$ is divided by $x - 8$. Thus, $f(8) = 7$.